bats

OF ALBERTA

"the real story..."

Alberta

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1986 01 20M

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Preface

Bats - The very word conjures up images of evil, witchcraft, and sorcery. 'Wings of bat and eye of newt' are two major ingredients in a potent witches' brew. Stealthily, bats stalk their prey on silent wings in the dead of night. They seek blood. They actively search out and terrorize people, particularly ladies with curly hair — or so the word of legends has it.

It is time to move beyond the thoughts and images of the dark ages. For centuries bats have been falsely maligned and often destroyed simply because they were different from all the other creatures. And they are different. They are mammals, yet they fly. They have wings but they are not birds. They are active at night and sleep upside down during the day. They look like mice but actually are more closely related to humans than to mice. They produce and interpret a fantastically complex series of sounds that we cannot hear, let alone understand. They can navigate in complete darkness yet also use their eyes during the day. These differences make them intriguing. This booklet is designed to set the record straight about bats. It provides solid evidence and scientific fact that bats are indeed worthy of our respect. It is hoped this will help replace the unjust image instilled by myth and legend with a more responsible understanding of the facts about bats.

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General Introduction

Bats constitute nearly one-quarter of all the known mammalian species in the world. They are nocturnal furbearing animals which feed their young milk produced in mammary glands. Bats are the only mammals to have achieved true flight and, thus, have many unique features. The bones of the hand are elongated to support the thin double membrane of skin which forms the wings (Figure 1). (The scientific name for the group - Order Chiroptera, means hand-wing). In most cases, there is also a membrane between the hind legs and the tail. This arrangement provides for amazing maneuverability, so that most bats are more adept at flying than many birds. The flight membranes are

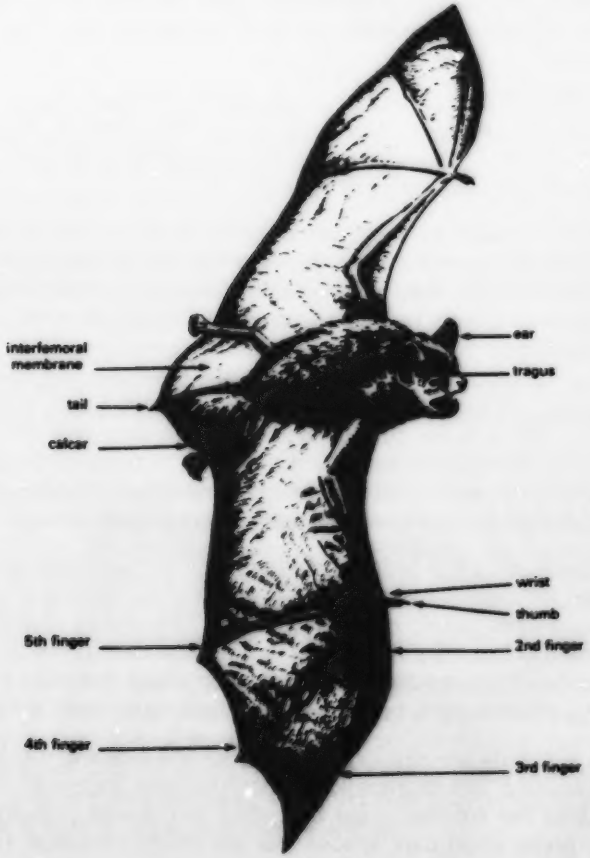

Figure 1. External morphology of a little brown bat.

also used to collect insects before they are eaten and to catch the new-born bats at birth. Some bats use their wings as raincoats while others use them as blankets. Although well adapted for flying, bats spend most of their lives hanging upside down asleep.

The navigational system of bats consists of a highly-developed sonar or echo-location system. Ultrasonic sound waves produced in rapid pulses ranging from 20 to more than 500 pulses per second are bounced off objects around the bat. Interpretation of the returning sound waves (the echo) allows the bat to determine the distance, speed, direction, texture, and size of an object. This system of echo-location is extremely precise and individual bats have a remarkable ability to identify their own signals and avoid confusion even when surrounded by thousands of other echo-locating bats. Vision is also important in navigating at short range. The aphorism 'blind as a bat' has no factual basis.

Nine species of bats have been identified in Alberta; however, only three species are encountered frequently by people. The remaining species reside as solitary individuals where people seldom see them, or else they are easily confused with the more common species.

All bats in Alberta are insectivorous and feed almost exclusively on flying insects. (They are the only major predator of night-flying insects). As bats have a high metabolic rate, they must feed voraciously in order to meet the high energy demands of flight, thermoregulation, and reproduction. A typical colony of little brown bats (*Myotis lucifugus*) can consume up to 50 kg (110 lb) of insects during one summer. An individual little brown bat has been reported catching and consuming 900 insects in an hour! Some prey species, particularly moths, have developed methods of detecting bat sonar and respond with patterns of evasive behaviour to try to avoid the predator. A few even produce their own sonar in an attempt to jam that of the bat or to warn of their distastefulness. However, bats remain very efficient feeders.

In Alberta, bats are near the northern limit of their distributional range. Since their food source is abundant in summer but absent in winter, bats exhibit a seasonal pattern in their life history. They are true hibernators and spend from 5 to 7 months in a state of torpor. Hibernating bats do not feed or drink, and their body temperature and metabolic rate decrease markedly. In this energy-efficient state, bats while away the long northern winters.

Bats in Alberta are all migratory, although the extent of migration differs between species. Individuals seldom spend summer and winter in the same roost. During the summer, most bats roost in colonies in buildings. They generally prefer small dark spaces that are poorly ventilated and heat up during the day. The optimum temperature in these roosts is 39° to 42°C. Bats commonly live in eaves and attics, behind facing boards, and around chimneys (Figure 2). They may take up temporary roosts behind shutters and sliding doors, under shingles and sidings or even in the open on walls. Roosting sites usually are within a few hundred metres of a source of water. The water

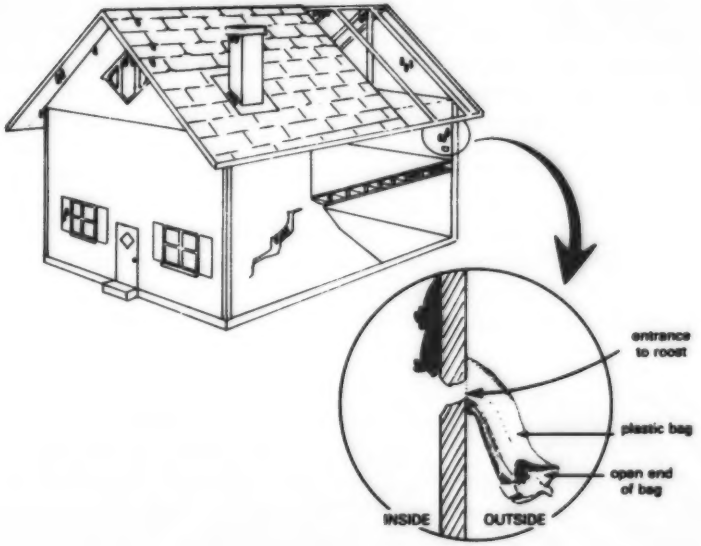

Figure 2. Roosting sites commonly used by bats in or on buildings. Inset shows details of one-way device to allow bats to leave but not return.

provides moisture for drinking which the bats obtain by swooping low over the surface. It also supplies an aquatic habitat to support high concentrations of insects.

There is little information about the winter habits of bats in Alberta. A few hibernating bats have been found in natural caves in the mountains and a few individuals of one species have been located in buildings. Some species hibernate within the province, others reportedly leave the area completely and spend the winter in a milder southern climate. However, it is not known specifically where the majority of our bats spend the winter.

Bats are extremely energy efficient. During the summer they rely on the sun to heat the roost and, thus, promote the rapid growth of young bats. Although they are warm-blooded animals, they can withstand a wide range of body temperatures. This allows them to take advantage of the heat energy on warm days, while on cold days during the winter their body temperature drops as they enter a state of torpor to conserve energy.

Very few animals eat bats as a main part of their diet. The major predators in Alberta are great horned owls (*Bubo virginianus*) and man. Most bats are killed by people, either intentionally by homeowners and vandals, or unintentionally by people destroying buildings and other roost sites. Although some bats may survive for up to 30 years, most die in their first or second year.

Little brown bats

The little brown bat (*Myotis lucifugus*) is the most common bat in Alberta (Figure 3). The provincial population is estimated at 1 to 1.5 million individuals. The adult females are relatively conspicuous as they roost together in colonies in occupied or unoccupied buildings throughout the province. The colonies are common in central Alberta and may be found in houses, schools, churches, garages and barns. Summer cottages close to bodies of water, for example, Wabamun Lake, Pigeon Lake, Gull Lake, Beauvais Lake, are often colonized by little brown bats. The largest colonies may be in buildings in good repair. Females are usually larger than males. On average, adult little brown bats weigh approximately 8.5 g (0.3 oz) and have a wing-span of up to 20 cm (8 in.).

The life history of little brown bats in Alberta is presented in Figure 4. Adult females appear at summer roosts in early May. During the summer colonies consist almost exclusively of pregnant or lactating females and their young (thus the term 'nursery or maternal colonies'). Colonies can consist of 3 to 1,100 bats but typically have from 50 to 300 individuals. Up to 98 percent of the females are pregnant each year; after a gestation period of 50-60 days, each female gives birth to a single young in late June or early July. The young are born blind, hairless, and unable to fly. They are completely reliant upon the female for care and maintenance during the first three weeks of life. The females are capable of identifying their own young and this is no doubt aided by the continuous squeaking of the juveniles whenever the female is absent. By three weeks of age the young bats generally are able to fly and begin to feed themselves.

Nursery colonies are characterized by hot dark conditions. They are poorly ventilated but often have more than one entrance. The high temperature promotes the rapid growth of young bats. The females exhibit high site fidelity and return to the same nursery roost year after year. Females relocated to other roosts during the summer rapidly returned to the original roost.

Little is known about where or how male little brown bats spend their time. A few have been found roosting individually in concealed roosts throughout the summer and are, consequently, difficult to locate. Similarly, juvenile females in Alberta are seldom found during their second summer but apparently join the other adult females after this time.

In the summer roosts, bats are often torpid or inactive during the day, especially during cool weather. Activity begins shortly before nightfall as the bats prepare to emerge for the evening feeding period. Not all individuals leave the roost each time. The bats return to the roost during the late evening, but leave again for another feeding period near dawn. They all return to the roost before sunrise and remain inside during the day.

Throughout August and September, many individual bats are seen flying at night or resting on walls and in alcoves during the day. At this time it is easy

to find bats on buildings along the main street of many communities such as Edmonton, Innisfail, Lac la Biche or Slave Lake. Red brick buildings seem to be preferred. The use of exposed roosts by bats may be more common in the northern part of their range and may be an adaptation to cooler temperatures. Direct sunlight may be important in providing heat energy during cool days.

In the fall, bats of all ages and both sexes rendezvous at caves in the mountains. This is the only period when large numbers of males have been found. This swarming activity is probably important in bringing large numbers of bats together for breeding. During this period, there is a rapid turnover of individuals at each cave which maximizes the exchange of diverse genetic material within the population. Sperm are stored by the hibernating females and fertilization occurs in spring.

Where most little brown bats hibernate in Alberta is not known. Hibernacula usually are cool, dark, humid places in which the air does not move and, thus, the environment is very stable. In the eastern United States, little brown bats hibernate in caves and abandoned mines. In Alberta, a few bats have been found in caves at Cadomin and Nordegg. No doubt other caves in the mountains or foothills also serve as hibernacula, but many bats may migrate to the northern United States or southern British Columbia. A few little brown bats have been found hibernating in caves in Wood Buffalo National Park. Males predominate in the winter roosts and the location of most females during the winter is unknown.

Big brown bats

The big brown bat (*Eptesicus fuscus*) (Figure 5) is probably the most common bat in southern Alberta, particularly in the vicinity of Lethbridge and Medicine Hat. The number of individuals gradually declines in the northern regions with only a few reports from the Peace River region and Wood Buffalo National Park. Big brown bats roost in colonies, often in schools, houses, and barns. In the southern part of the province, red brick buildings more than 40 years old are preferred. Adult big brown bats weigh 15 to 25 g (0.5 to 0.8 oz) and have a wingspan of 30 cm (12 in.).

A colony in Alberta may consist of 10 to 80 individuals; southern colonies are slightly larger than those in the north. Summer colonies consist predominantly of adult females; juveniles are present later. There is strong site fidelity, with females consistently returning to the same nursery roosts each year, arriving in early May. Parturition (birth) is not synchronized and may be any time from May through June. Litter size in Alberta is usually one young per female. The pregnancy rate is approximately 92 per cent in adult females but many yearling females do not produce young until their third summer. The sex ratio at birth is approximately 1:1 and the rate of mortality appears similar in males and females. Life expectancy is one to two years, however, some individuals live up to 20 years.

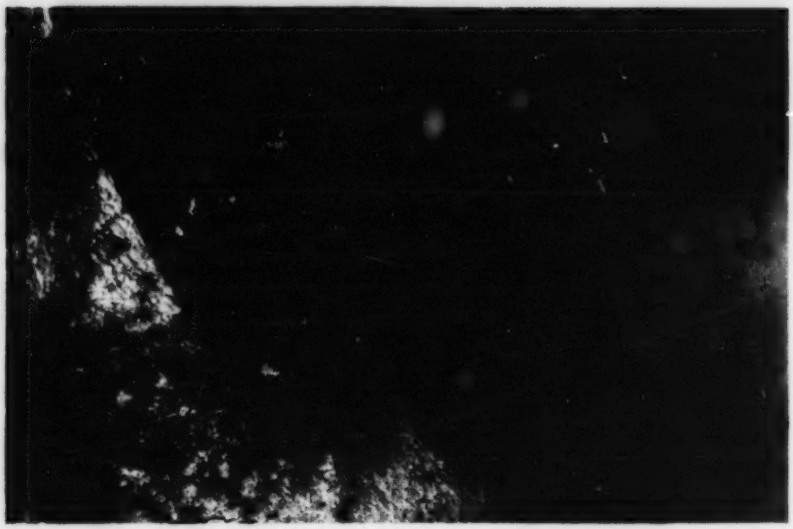

Figure 3. Little brown bat.

Figure 4. Life history of little brown bats in Alberta.

Figure 5. Big brown bat.

Figure 6. Silver-haired bat.

Figure 7. Hoary bat.

Figure 8. Adult male red bat.

Juveniles are tended only by the adult females. Birth weights range from 2.5 to 3 g. The young can fly and forage for themselves after four weeks while adult size is attained by ten weeks. Juvenile males may mature and breed in their first fall, but as indicated earlier, in northern populations females rarely produce young until their third summer.

Big brown bats are relatively sedentary. They use an aggregation of roosting sites within a small local area and usually forage within 3 or 4 km of their day roost. Flight patterns and feeding activity are consistent among members of the local population and often are associated with concentrations of night-flying insects. For example, bats roosting 2 km south of Stony Plain, Alberta, fly into town each night to feed on insects gathered around street lights.

Big brown bats are able to tolerate cold better than most bat species. A few individuals have been found in environmental temperatures of -15°C; however, usually they hibernate before such extremes are reached. Although few details are known about the hibernation of big brown bats in Alberta, it appears that buildings are the preferred sites. (They are the only species of bat known to hibernate in buildings in Alberta). As the number of big brown bats found in Edmonton is greater in the winter than in the summer, it is thought that the bats may move into the city to hibernate.

Big brown bats seldom move more than 120 km between nursery and hibernation sites. Some individuals use the same site as a nursery roost and a hibernaculum. Hibernacula are characterized by low humidity, variable temperature and often, considerable air movement. If the temperature in the hibernaculum drops below -4°C, big brown bats will arouse themselves from torpor and seek a warmer site. This behaviour may explain many of the reports of bats seen during the winter in Alberta. Males and females in the United States appear to hibernate separately in caves and buildings, respectively. It is not known whether this pattern is true for big brown bats in Alberta.

Silver-haired bat

The silver-haired bat (*Lasionycteris noctivagans*) is a noncolonial woodland bat which is rarely found in buildings (Figure 6). Though widely distributed in North America, it is most abundant in the northern Rockies. Males and females appear to use separate ranges during the summer but apparently winter together in the southern United States. Silver-haired bats are distinguished by their size — they have a wingspan up to 30 cm (12 in.); colour — black wing membranes and dark silver-tipped hair; and flight — slow and leisurely, often close to the ground. They are strong fliers and some migrate seasonally from Arizona to northern Alberta. Silver-haired bats use tree roosts during the summer. They may be found as individuals or in small groups under bark, in abandoned bird's nests, in hollow trees, or hanging upside down amongst the leaves throughout the forests in central Alberta. During the winter,

they hibernate under the bark of trees, in rock crevices, and, occasionally, in buildings in the southwestern United States.

Owing to their solitary nature and avoidance of humans, little is known about silver-haired bats in Alberta. They appear to be present in southern Alberta only during the spring and fall migrations (April to July, August to October, respectively). Males do not appear to migrate and, thus, records in Alberta include only adult females during the spring, and females and juveniles during the fall. Litter size is two young per female. During migration, the bats often use temporary daily roosts in open sheds and garages or on piles of lumber, railroad ties, or fenceposts. The bats are most conspicuous at this time. The specific location of the summer and winter roosts is unknown.

Hoary bat

The hoary bat (*Lasiurus cinereus*) is the largest bat found in Alberta (Figure 7). Adults may weigh up to 35 gm (1.2 oz) and have a wingspan of 40 cm (16 in.). Their long narrow wings provide a strong, powerful, and rapid flight. The body and interfemoral flight membranes are covered with thick dark brown or black hair. Many of the individual hairs are tipped with white, giving a 'frosted' or 'hoary' appearance. The 'frosted' coat may provide camouflage by making the bat look like lichen or a withered leaf on tree bark.

Hoary bats are solitary individuals which roost in areas of forest cover. During the day, they are concealed among the leaves or on the bark three to four metres (10-12 ft) above the ground. One female in Wisconsin returned to the same spot on a spruce branch at least three years in a row. Hoary bats appear to prefer evergreen trees, and could live throughout the boreal forest zone of Alberta. The bats leave the trees after dark to feed on nocturnal flying insects.

Hoary bats are distributed widely throughout North, South, and Central America and are one of the most widespread of mammals. They are the only wild land mammal to naturally colonize the Hawaiian Islands. As they raise their young throughout Canada and the northern United States, but winter in the southern United States and Mexico, they must undertake long migrations in the spring and fall. Males apparently spend the summer in the western United States. Females migrate farther than males; most of the hoary bats found in Alberta are females or females with young. Each female bears two young in late June. The juveniles stay in the tree while the female forages for food.

Long-legged bat

The long-legged bat (*Myotis volans*) is common throughout western North America. However, it is morphologically similar to the little brown bat and often misidentified. Long-legged bats can be distinguished by thick hair extending on the underside of the wing to a line from the elbow to the knee and

by the presence of a keeled calcar (a small bone extending laterally from the ankle).

Little is known about the habits of long-legged bats in Alberta. In the United States, they roost in buildings, rock crevices, and trees. Many nursery colonies are in trees and may consist of hundreds of individuals. It is not known where the majority of these bats hibernate.

Long-legged bats have been collected repeatedly at Cadomin cave. They use the cave as a swarming site in August and September and a few individuals also hibernate there. Long-legged bats may be quite tolerant of cold.

Small-footed bat

The small-footed bat (*Myotis ciliolabrum*) is relatively common throughout the western United States and the arid regions of Alberta, British Columbia, and Saskatchewan. It is easily confused with other myotis species and can be identified reliably only after extensive experience. Nursery colonies have been found in caves and crevices in rock faces and clay banks. This species may be widespread in the badlands and arid river valleys in the Milk River area. It has been collected sporadically in southern Alberta, particularly from Dinosaur Provincial Park. Collections made in Dinosaur Park suggest some small-footed bats bear young in the park and may hibernate there.

The small-footed bat is a hardy species. In the western United States, it is the last species to enter hibernacula but the first to leave. Individuals hibernate in narrow crevices near the mouth of caves. Here the temperature often dips below freezing yet the small bats appear to be well-adapted to the cold and dryness. Some small-footed bats are known to hibernate in south-central Montana.

Eastern long-eared bat

The eastern long-eared bat (*Myotis septentrionalis*) is distributed widely throughout Canada but seldom is seen. In western Canada, it is restricted to the boreal forest areas. Specimens have been collected in Alberta from Edmonton, Cadomin, Peace River, High Level, Edson, Spruce Grove, and Wood Buffalo National Park. Eastern long-eared bats look very much like little brown bats. They differ in having long ears which extend up to 4 mm beyond the end of the nose when laid forward.

Myotis septentrionalis appears to congregate in small nursery colonies (up to 30 individuals) where each female probably gives birth to one young each year. During the summer these bats roost in a variety of shelters including buildings, trees, and caves. Like the small-footed bat, this species is quite tolerant of cold and in winter prefers to roost singly in narrow crevices near the entrance of mines and caves.

Long-eared bat

The long-eared myotis (*Myotis evotis*) as the name implies, is characterized by long ears which extend well beyond the tip of the nose when gently laid forward. The ears are black. This bat is a western species restricted largely to mountainous regions although a few colonies have been found in the prairies, for example, at Hesketh. The preferred habitat appears to be coniferous cover high in the mountains of British Columbia and Alberta.

Long-eared myotis probably roost in trees in the summer but individuals collected for scientific study in Alberta usually are collected at caves in the fall. Some of these bats swarm at Cadomin cave in August. Nursery colonies consist of 12 to 30 individuals. Each female bears a single young each year. The winter habits of the species are unknown.

Red bat

The red bat (*Lasiurus borealis*) is an infrequent visitor to Alberta and is found more commonly in the southern and eastern United States and in eastern Canada. They are solitary bats which roost in thick forest cover. During the day the bats hang by one foot from the base of a leaf, giving the appearance of a dead leaf. This behaviour may provide some protection from predation by blue jays, hawks and owls.

Red bats are one of the brightest-coloured bats, ranging from bright orange to light rusty brown (Figure 8). Adult males are usually redder, while females are 'frosted' with white. They are a moderate size, weighing 7 to 12 gm (0.3-0.4 oz) and have a wingspan of up to 30 cm (12 in.). Red bats are migratory and the few collected in Alberta were females. One to four young per female are born under a leaf in late May or early June but many are killed by blue jays.

Red bats are well-adapted to living in an environment of fluctuating temperatures. The tail membranes are thickly furred and can be used as a blanket to cover the bat during hibernation. So much heat energy is conserved through various behavioural and physiological adaptations that red bats may be unable to survive in the stable environment present in caves. This may be the reason they hibernate in trees.

Diseases and parasites

Contrary to popular belief, few parasites and diseases of insectivorous bats pose any threat to human health. Rabies, an acute infectious disease of the central nervous system, is an exception. It has been identified in a variety of bats throughout Canada and the United States; however, many of the facts about rabies have been sensationalized and misrepresented. The following information summarizes what is known about rabies in insectivorous bats and indicates clearly that although individuals should be handled cautiously, widespread fear and persecution of bats is unwarranted.

Rabies probably has been present in insectivorous bats in North America for a long time, but it was first identified in 1953 in Florida. The virus is maintained within bat populations and is transmitted between individuals of the same or different species. It overwinters in a dormant or latent state in hibernating bats and is re-activated by stress or by a return to the normal metabolic condition of the bat after hibernation. This mechanism gives rise to rabid bats in early summer and fall. Bats which undertake long rigourous migrations are subject to added stress which may affect development of the virus.

Rabies has been diagnosed in little brown, big brown, silver-haired, hoary, and one small-footed bat from Alberta. Most rabid bats are collected in August and September. The number of infected individuals differs from year to year and between species, but is consistently low. Bats collected randomly from nursery colonies by Fish and Wildlife personnel rarely are infected with rabies (1 of 1500 tested since 1979). Prior to 1979 infection in bats collected randomly was approximately one per cent.

Most of the bats collected by the public and submitted for rabies testing are collected because they behave abnormally and/or appear sick (= suspect bats). In spite of this, few rabid bats are found. However, 13 rabid bats were collected from one roost in an occupied house near Penhold in 1973. Between January 1979 and December 1983, rabies was diagnosed in one of 467 (0.4%) little brown bats, 23 of 223 (10%) big brown bats, 12 of 203 (6%) silver-haired bats, and 4 of 23 (17%) hoary bats submitted by the public in Alberta.

The prevalence of rabies in little brown bats decreased significantly between 1973 and 1978 and the virus has all but disappeared in this species since then. The prevalence in suspect big brown bats has remained relatively constant at 5 to 10 per cent throughout the documented time period. The prevalence in suspect silver-haired bats has been erratic, ranging from 0 to 18 per cent in 1979 and 1981, respectively. The number of hoary bats submitted for testing was too low to establish the rate of infection.

Rabid bats were distributed widely throughout the province and generally reflect the presence of people (Figure 9). Sick or dead bats in uninhabited areas would go unnoticed. The higher number of bats collected in southern Alberta is associated with increased public awareness and concern about rabies in this area.

When bats inhabit a building, they pose little threat to the safety of people or animals within the area. Their nocturnal habit of feeding exclusively on insects means they seldom interact with humans. There are few valid accounts of bats attacking people, even rabid bats rarely become aggressive. The major problem comes from directly handling bats since like most wild animals, biting is one of their defensive reactions. Any bat found on the ground should be collected and tested for rabies (contact the District Federal Veterinarian). If the bat is handled, gloves should be worn. If a person is bitten, the wound should be washed immediately and medical assistance should be

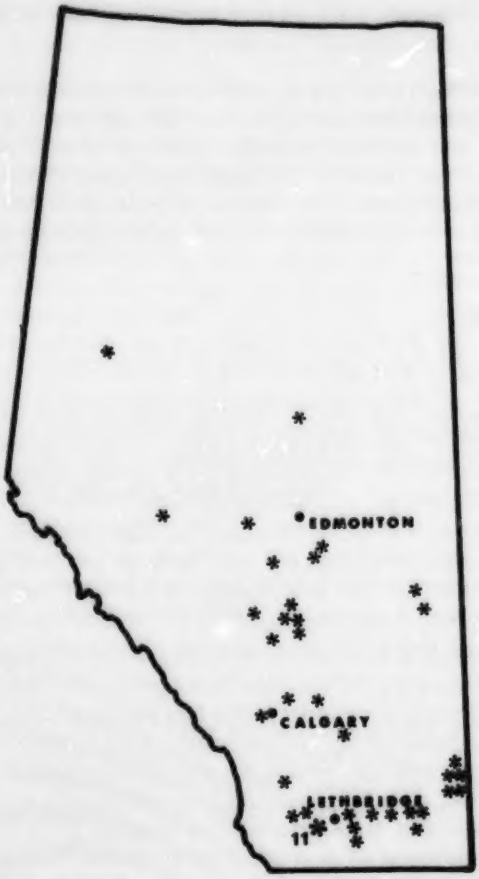

Figure 9. Distribution of rabid bats in Alberta, 1979 to 1985, inclusive.

sought. The animal should be collected if possible and submitted for rabies testing.

Information concerning the potential danger from rabies in forest-dwelling bats is incomplete. In July 1985, one man apparently contracted rabies from an unknown forest-dwelling bat in northern Alberta. He did not notify health officials and did not receive rabies preventative vaccine before or after the exposure. In December, the man died of the disease. This is the first recorded human fatality due to exposure to rabies in Alberta. Although the prevalence of rabies is considered low in bats in Alberta, any incident resulting in direct contact and a bite from an unknown bat should be reported immediately to health officials. Appropriate follow-up procedures can then be considered. A new fast, effective, and relatively painless anti-rabies vaccine is available to prevent the disease in humans.

Pre-exposure immunization should be considered in any occupation with a high potential for contacting wild animals.

Gone are the days when contact with a rabid animal leads to a long series of painful inoculations often with unpleasant side-effects. The new vaccine, human diploid cell vaccine, requires a maximum of five inoculations administered into the muscles of the upper arm to give full protection against infection. Because the vaccine is of human origin, there is little or no reaction against it. However, the protection it provides develops rapidly and lasts a long time.

Bat control

Perhaps the most important question in controlling or removing bats is whether or not to do it. Bats are a natural element in the ecosystem and play an important role as predators of a variety of flying insects. All species of bats are considered wildlife and are protected under The Wildlife Act. They hibernate for six to seven months of each year and are inactive for up to 20 hours each day during the summer. They are inconspicuous and unobtrusive. The prevalence of diseases in bats in Alberta is so low that widespread eradication of bats to eliminate a human health hazard is unjustified.

Contrary to folklore, bats are not elements of evil. Although a few cases were reported in the early 1970's, bats do not indiscriminately attack people nor are they particularly attracted to ladies hair. However, bats are not always blameless. As indicated earlier, some bats have the annoying habit of roosting in or on occupied dwellings. This is not always appreciated by the people sharing the building. Bats produce large amounts of urine and faeces which may result in odour and damage to wooden surfaces. Note that they do **not** chew insulation, electrical wires, or structural elements. Thus, damage usually is minimal and the problem is psychological more than anything else. Young bats squeak incessantly if the female is away, and this is sometimes enough to drive people 'batty'. Ectoparasites that live on bats only try to bite people if there are no bats to feed on, i.e., AFTER control measures have been taken. However, where bats are roosting in areas accessible to children or where the owner is not willing to co-exist with bats, control methods can be undertaken.

The ONLY SURE METHOD OF GETTING RID OF BATS IS TO PREVENT THEIR ACCESS TO THE BUILDING. First, locate the entrance holes to the roost. By watching the building at dusk, it is often possible to see exactly where the bats are coming out. During the day, you can look for bat droppings (they look like mouse droppings) stuck on the wall of the building or accumulated in piles on the ground. The entrance to the roost will be somewhere above the droppings. The entrance usually is surrounded by a narrow dark brown oil smear (the oil and dirt rub off the bats as they enter the roost). Bats squeak and rustle as they crawl in the roost and this helps pinpoint exactly where they are located. When searching for entrance holes, remember the rule of thumb - that

a bat can probably squeeze through any space big enough for your thumb to fit through.

Batproofing a house may involve screening louvres, vents, chimneys, and large ventilation openings with 6 mm (0.2 in.) mesh hardward cloth; closing small cracks in eaves and rafters with caulking compound, sidings or sheet metal; nailing down loose shingles or facings; sealing the joint between the roof and the chimney with sheet metal, cement, or mortar. If mothballs are used, 1.5 to 2.5 kg (3 to 5 lb) should be sprinkled throughout the attic. After the bats are driven out, seal the entrances. Close off or seal all openings except one (using screening or caulking). On the outer side of the remaining entrance, place a one-way device (plastic bag with both ends cut out) (see Figure 2). Bats can now get out through the bag, but cannot return. More elaborate devices of slotted tubes and valves achieve the same results. Now, your knowledge of the biology of bats becomes important. Not all bats leave the roost every night. Therefore, if you close off all entrances, some bats will be trapped inside. They may become frantic and in seeking alternative exits, come out inside the building (thus, the plastic bag to let them out).

Attempts to remove bats from buildings should not be conducted in June or July. Young bats, not yet able to fly, will be trapped inside where they will eventually starve. The most common house bat, the little brown, migrates away from buildings each fall. Thus, the wisest course is to wait until October and then plug all the entrances to the roost. When the bats return in spring, they will be unable to get in.

Various other methods have been used to remove bats. These can be grouped into general categories of chemicals (e.g., DDT, fenthion, zinc phosphide, anticoagulants), sticky substances (e.g., Tanglefoot, Tacky Toes), and habitat manipulations (e.g., artificial light, mothballs, ultrasonic rodent repellers, exclusion devices).

Research and field experience consistently show that the application of chemicals or sticky substances generally is ineffective in solving bat problems. The use of chemicals often results in dazed or weakened bats which may be picked up by children or pets. In addition, stress due to sublethal doses may result in a bat becoming more susceptible to infection (e.g., activation of latent rabies infection). All studies indicate that these **poisons should NOT be used** in attempts to control populations of insectivorous bats.

As bats prefer dark spaces, artificial light has been used successfully to drive bats out of some attics. The light must be kept on continuously and moved regularly. Otherwise the bats soon find dark corners or shadows in which to avoid the light.

Mothballs (paradichlorobenzene), vapourizing pest strips, formalin, and concentrated bleach also have been used successfully. However, these chemicals only work in small areas where the noxious fumes can accumulate. In addition, success is temporary. Once the fumes weaken, the bats will return.

Ultrasonic repellers are ineffective as a deterrent against an animal which uses ultrasound waves in many aspects of its life. They may actually attract bats.

Bats have been persecuted needlessly since the dark ages. In reality, they are an essential link in the balance of nature and an important part of the natural fauna of our province. They provide a valuable service in consuming many flying insects and pose little threat to human health. There is no evidence that widespread destruction of bats or their roosts has reduced the already low health hazard. Control of bats should be done by excluding entry into buildings, not by killing the bats.